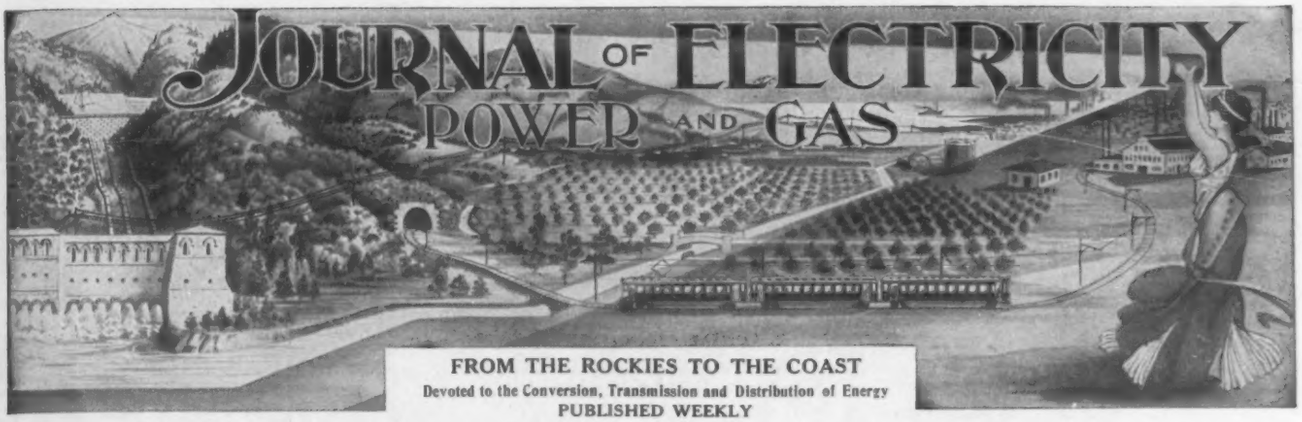
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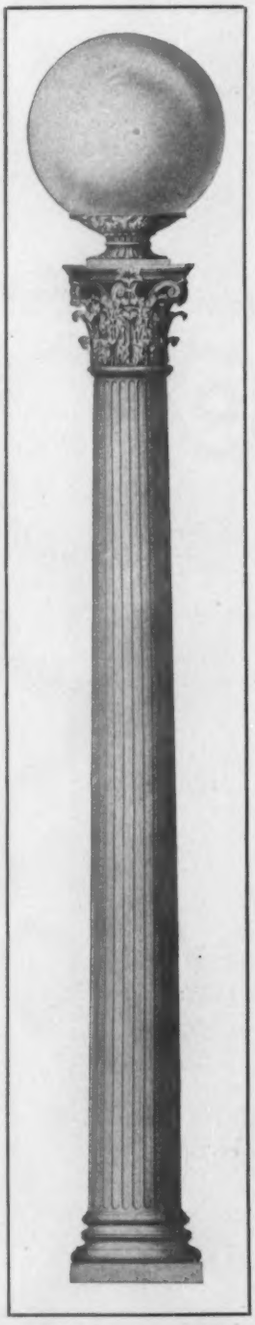

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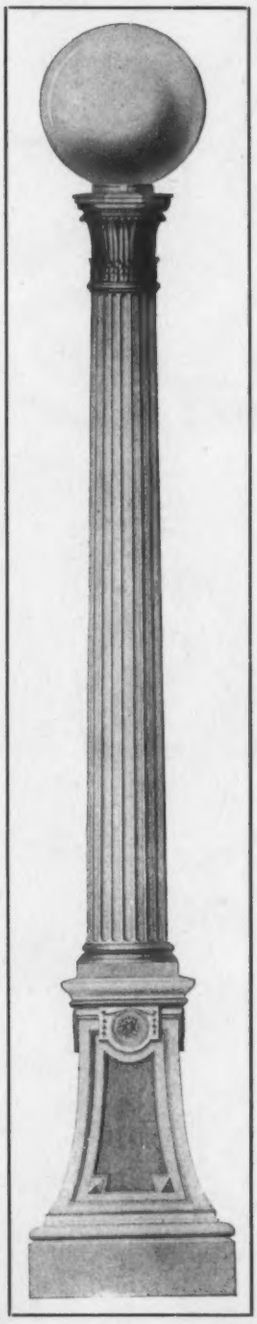

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Journal of Electricity, Power and Gas

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VOLUME XXI. SAN FRANCISCO, CAL., OCTOBER 24, 1908 No. 17

STEAM PLANT—SEATTLE-TACOMA POWER COMPANY.

By A. S. KALENBORN.

An interesting installation has just been completed in Seattle, Wash., for the Seattle-Tacoma Power Company. The interest lies, not in the size of the plant, but in the fact that in connection with a steam heating system electric energy to the extent of 1,000 kilowatts is obtained in a manner as a by-product.

The boilers of the heating plant must furnish steam for an adjoining ice plant and for a laundry in the next block, at a pressure of 140 pounds, and, as the steam for heating is distributed at from two to eight pounds, a reducing valve is necessary to let the boiler pressure down through this range.

The several small direct-current generators, supplying the three-wire service, were driven by belt from a horizontal engine, by direct connection to another horizontal, and a pair of them were included in the de Laval twin turbine set.

Exhaust from these three engines, and that also from the engines in the ice plant, with the assistance of a reducing valve lowering boiler pressure to that in the mains, supplied the heating mains with steam.

Recently, the Seattle-Tacoma Power Company acquired both the ice and heating plants. The Seattle-Tacoma Power Company is the successor to the Snoqualmie Fall and White River Power Company, and operates the unique hydro-electric plant in the cavity under Snoqualmie Falls, and the transmission lines to, and the sub-stations and distributing lines in, Everett, Seattle, and Tacoma.

Seattle-Tacoma Plant Furnishing Steam to Refrigerating Plant and Generating Electric Power.

Since the heat energy in steam has in this particular locality a market value of approximately one-fifth that of the more refined energy in the form of electricity, by making the cylinder of the engine that drives the generator act as a reducing valve, a double purpose is served and considerable profit is also derived by the arrangement.

In general the conditions were as follows: The Mutual Light and Heat Company held an exclusive franchise for the heating by steam of a district one-half mile square in what is now the heart of Seattle's retail business section. It also distributed direct current—220-volt, 3-wire—for lighting and motor service within this section, and had built up a considerable load.

Adjoining the power plant of this company, located on Western Avenue, near Union Street, on the water front, was the Diamond Ice and Storage Company, which obtained its steam for refrigeration and ice-making from the heating company, and at a distance of a block and a half was a steam laundry similarly operated.

To keep up with the power and heating loads, it was necessary to make additions, and these additions are the subject of this article. It was decided to displace the small direct-current units by a 500-kilowatt rotary, and to install a power-producing reducing valve sufficient to take the average steam load required by the heating system. The heating mains in the streets were to be enlarged also, for present conditions and for future extensions, and a general comprehensive plan of distribution.

The plant, at the time it was taken over, consisted of a boiler capacity of 1200 horsepower in two batteries of 300 horsepower units, with an 8x28 tube economizer, a short steel stack and induced draft-fan equipment, two boiler feed-pumps, mechanical stokers and coal-handling apparatus, and the small direct-current generators previously mentioned with a combined capacity of 520 kilowatts.

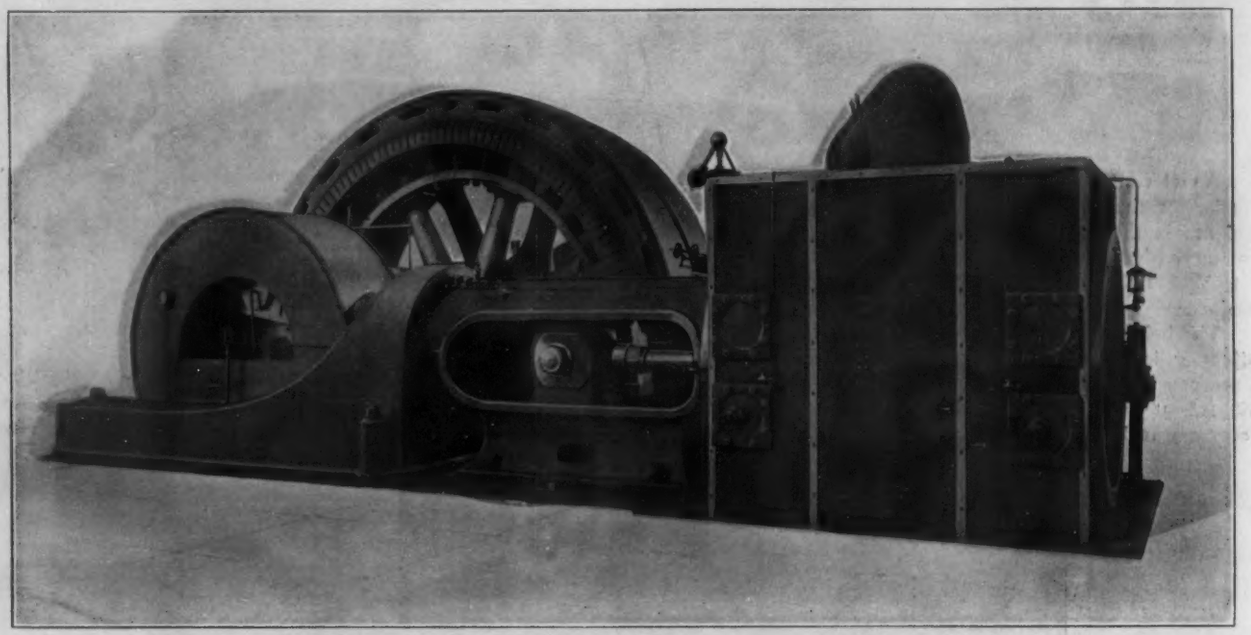
The drawings show *plan* and *longitudinal section* of the plant as it stands, with the additions indicated as "future" to be installed as the load demands.

Besides what is there shown, the mains in the street were overhauled and larger ones were laid. An interesting part of this work will be described later in this article.

next to the railroad track. A duplicate system of pumps, heaters and piping supplies oil from these tanks to the burners in the furnaces.

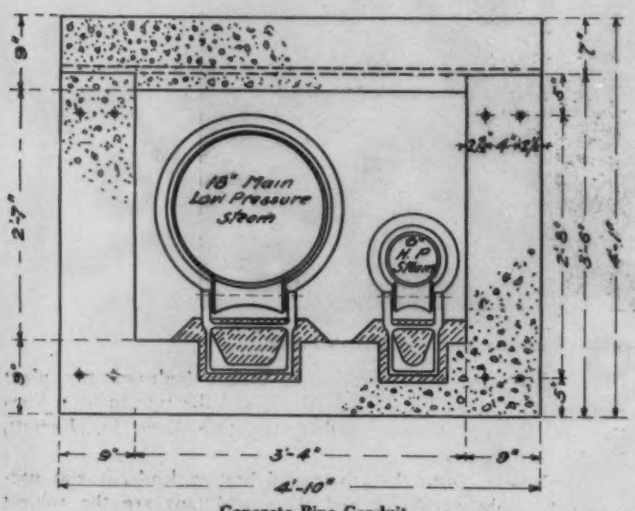
The boilers, economizers and oil-handling apparatus were furnished and installed by C. C. Moore & Company.

When the change to oil was made, the stack was extended



Horizontal Cross Compound Reynolds Heavy Duty Engine Used as a Reducing Valve.

During the past winter the boiler capacity of 1,200 was over-taxed considerably for long periods, and due to the opening of new streets and the great amount of building going on in the district covered by this system, it was decided to install



Concrete Pipe Conduit.

two 400-horsepower boilers as an addition. These are of the B. & W. water tube, non-superheating type, and are installed in the former location of the small generators.

For this battery of boilers, an 8x28 tube Green Economizer was installed, and for boilers one and two formerly not so supplied, a 6x28 tube Green Economizer was erected.

During the spring and summer of '07 the price of coal was forced up, while the price of fuel oil was practically stationary. A change was made, accordingly, from coal to an oil-burning system.

Two large oil-storage tanks with a combined capacity of 890 barrels were buried outside the building, in a concrete vault

to allow of operation under natural draft, reserving the fan for use on "heavy" days, when the natural draft is sluggish, and for periods of heavy draft on the plant.

Three 10x6x10 Worthington boiler feed-pumps, and a 1,000-horsepower Wainwright feed-water heater take the place of the old apparatus formerly in service.

To accommodate the new power units, it was necessary to build an addition to the plant. The Eastern or Western Avenue end of the lot was occupied by a machine shop and yard. This was removed, the ground was cleared and excavated, and a brick building seventy-five feet by fifty-three feet nine inches by thirty-six feet high was erected. As the ground had been made of heterogeneous fill on an old sawmill dump, it was necessary to support the building and machine foundations on piles; 340 of these were driven to original beach.

Concrete in considerable quantities was used in the foundations. The walls are of brick, with heavy pilasters to support the crane runway and the roof. The roof, a flat, pitch one, supported by light steel trusses, is built of Ferro Inclave. This is a corrugated steel with dove-tail grooves, instead of the usual "sine waves," allowing the lower side to be plastered. In this way a light, strong, fireproof roof only one and three-eighths inches thick is obtained. This style of roof is also cheaper than the ordinary concrete roof four to six inches thick, which requires, in addition to the greater amount of concrete, the use of forms and their support. The Ferro Inclave is manufactured by the Brown Hoisting Machinery Company, Cleveland, Ohio. The 25-ton traveling crane is a hand-operated one, manufactured by the Whiting Manufacturing Company.

The apparatus to be accommodated in this addition, is two 1,000-kilowatt, 2,300-volt, 2-phase, 60-cycle generators, direct-connected to cross compound horizontal steam engines, two 500-kilowatt, 220-volt, 3-wire, rotaries, and two 400-horsepower boilers. This last addition will make an ultimate boiler capacity of 3,600 horsepower.

The requirements for a prime mover for this station were not so much high efficiency and low steam consumption, but simple, rugged construction of good materials and low price. This engine is primarily a reducing valve.

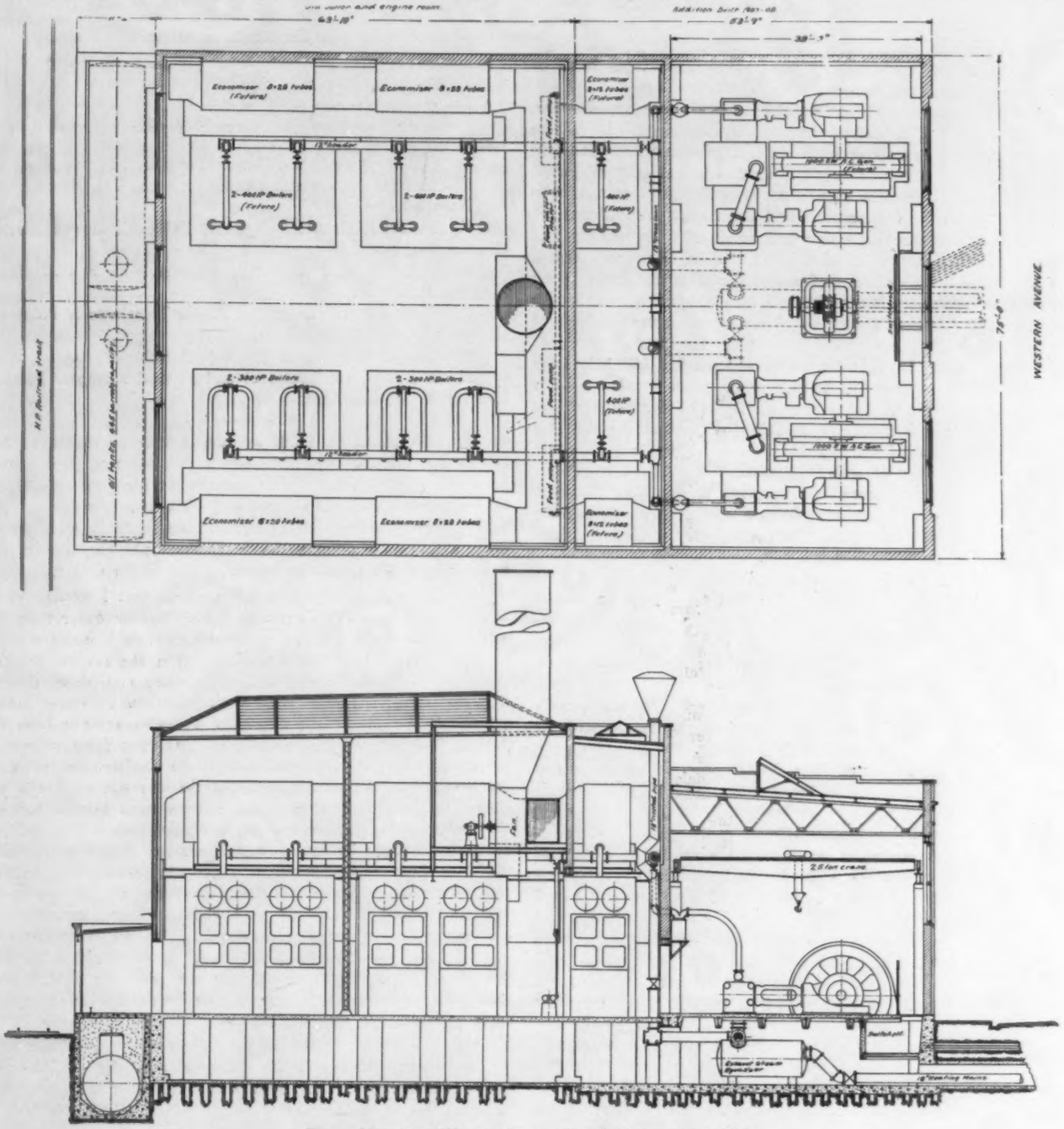
The horizontal cross compound engine was selected for this work, since it filled all the requirements. The steam turbine was eliminated because of its inability to operate as satisfactorily as does the compound reciprocating engine under varying back pressure.

Low steam consumption with its attendant high cost in the price of the engine would hardly be justified, if, as may be the case most of the time, besides passing as much steam as possible through the engine, considerable steam will have to be supplied through a "bleeder" to furnish the necessary steam to the heating system. The initial unit was built and erected by the Allis-Chalmers Company, and consists of a 24-inch by 48-inch by 36-inch horizontal cross compound Reynolds heavy duty engine, direct-connected to a 1,000-kilowatt, 2,300-volt, 2-phase, 60-cycle generator running at 120 revolutions per minute. The first rotary is a Westinghouse machine, 500-kilowatt, 220-volt, 3-wire, transforming from sixty cycles. The old turbine-generator set has been retained as an exciter.

As indicated in the drawings, directly under the rotary, in the basement, a large steam equalizer has been placed, and this is interposed between the engine exhaust and the two 18-inch steam mains, for the purpose of trapping out the water of condensation, and also to eliminate the pulsations in the steam flow.

Branches tee off to exhaust heads on the roof, allowing the engines to be operated at full load when the demands of the heating system are light, and further provision has been made to connect to condensers in case this is ever necessary or desirable.

The switchboard stands on the main floor, between the large units, over a pit eight feet by sixteen feet by five feet deep, and in this pit will be located all the oil switches, current and potential transformers and 2,300-volt wiring. The switchboard will accommodate, besides the former local direct-current circuits, three 2,300-volt, alternating-current circuits connecting with the



Plan and Section of Western Avenue, Seattle-Tacoma Steam Plant.

company's city distribution, and also with the H. T. sub-station on the hill, at Seventh and Jefferson Streets. Inter-connections can be made through these circuits to the H. T. lines, so that in case of trouble at the Falls or on the transmission lines, the steam-driven generator can be used to assist in maintaining service on the system.

At present, the circuits leave the plant overhead, but when these are installed in conduits underground, all dangerous wiring will be kept below the floor in a fireproof pit divided into several compartments. Only the instrument and lighting wires will run to the switchboard. This makes a very good arrangement, and can no doubt be applied to advantage in many instances of station design.

In connection with the heating mains in Western Avenue, construction a little out of the ordinary was required. Where the mains are laid above high-tide level, the usual method was employed, *i. e.*, pipes of requisite size, insulated with magnesia, were incased in wooden logs or conduits. These pipes rest upon rollers to allow of expansion and contraction and liberal air space is allowed between pipe and conduit. This method had to be modified somewhat for the mains in Western Avenue. The surface of this street in front of the plant and from Union Street to Yesler, is but seven and one-half feet above Seattle datum, and the high winter tides rise to about two feet above datum. The requirements of the City Engineer's office for steam mains, is that they be buried at least five feet below the surface of the street. An 18-inch main in its wooden conduit would in this case be below the tide level. Evidently a waterproof conduit was necessary in this district, and the drawing shows the section of the concrete duct or tunnel built to attain this end. This tunnel was built without a roof, of trough or U shape; the pipes were laid in place therein and then the cover slabs having a slight projection or shoulder entering the top of the tunnel were placed. This was to avoid lateral displacement by the thrust of the soil.

A mortar of cement, sand and lime, was used for the joints between cover and tunnel, so that these may be broken readily if at any time it is decided to make extensive repairs to the mains. Inspection is possible to a man crawling through the tunnel from manhole to manhole, preferably after steam has been turned off the mains for a time.

The installation of the new 18-inch mains has materially reduced the pressure necessary at the power house required for proper service of the steam heating system.

Pressure gauges installed at the terminals of various mains show simultaneous values at the station, facilitating the intelligent regulation of pressure to meet the demands of varying load, by the station operator. Prior to the placing of these gages which correspond to the potential wires, from centers of distribution in connection with electric installations, the station attendant maintained constant pressures at the plant and raised it only when complaints were received from a customer whose service was below normal. Having determined upon normal pressure at the end of a line it is now only necessary to keep within say one-half pound of this pressure irrespective of the pressure applied at the plant. That is to say, if the customer most liable to poor service is assured of uniformly good satisfactory pressure the rest of the connected load must necessarily be so. From experiences with this work it seems that this combination of steam heating and electric plants works out very well, and could probably be studied and applied to advantage in numerous cases throughout the country.

F. G. Baum & Company, of San Francisco, California, were the engineers for this work, Mr. A. S. Kalenborn, manager for the Northwest office, being in direct charge of all operations.

RECENT DECISIONS.

That a municipal corporation operated an electric light plant in a public capacity is held to be no answer to a claim of liability on its part for permitting uninsulated wires to obstruct its public streets. (Palestine vs. Silver, 8 L. R. A. (N. S.), 205.

HIGH TENSION INSULATORS.

Discussion by members of the San Francisco Section, American Institute of Electrical Engineers, of paper read by Mr. H. R. Noack, as published in the JOURNAL OF ELECTRICITY, POWER AND GAS of October 17, 1908. The following members participated in this discussion:

P. M. Downing, operating engineer, California Gas & Electric Corporation, Chairman *pro tem.*

A. G. Jones. General Electric Co., San Francisco.

A. J. Bowie, Jr., engineer, San Francisco.

H. M. Crozier, with Sanderson & Porter, San Francisco.

Thomas Anderson, Westinghouse Electric & Mfg. Co., San Francisco.

S. B. Charters, instructor Leland Stanford Jr. University.

S. L. Foster, chief electrician, United Railroads of San Francisco.

C. W. Hutton, designing electrical engineer, Sacramento, Cal.

L. R. Jorgenson, designing engineer, with F. G. Baum & Co., San Francisco.

C. F. Adams, electrical engineer, California Gas & Electric Corporation.

A. S. Kalenborn, constructing engineer, with F. G. Baum & Co., San Francisco.

C. W. Burkett, chief engineer Pacific Telephone & Telegraph Company.

W. G. Vincent, with C. L. Cory, San Francisco.

H. R. Noack, vice-president and general manager, Pierson, Roeding & Co., San Francisco.

The Chairman. I think we owe a vote of thanks to Mr. Noack for the very complete paper that he has given us on porcelain insulators. He has taken the art from the clay to the insulator on the line and covered it, I think, very completely. The subject is now open for discussion and we would be glad to hear from any one. Mr. Jones, of the General Electric Company, is here, and we will be glad to hear from him on the subject.

A. G. Jones. I have just a few points that I would like to add to Mr. Noack's interesting paper on the subject of insulators. In the first place, when the mixture comes from the plug mill which Mr. Noack spoke of, it is the general practice I believe, to allow the clay to age for some little time; that is, it is usually placed in a brick vault with jets of steam spraying about so as to get the clay after it has been taken from the presses into the proper homogeneity. Another thing is that in the manufacture the centers seem to be the weakest point in the insulators. All of the tops and the intermediate shells are shaped on jiggers; that is, they are made on a hand lathe; but the stems, owing to the trouble in making the proper threads in them, have to be more or less pressed. Instead of being made by the shaping process they are composed of a combination of the two; that is, the mould in which the stem is made is placed in a type of drill press and a mandrel, or whatever you might call it, comes down in the clay and presses it into the proper form,—thus moulding the interior shape; the plaster of paris mould gives the outer shape; the end of this drill cuts the proper thread in the stem. The "pressing" effect causes more or less irregularity, and therefore the inherent weakness of the stem or center.

Each part is tested to its arcing-over point, with the exception of the head. The head is usually tested at normal line voltage; that is, on a sixty thousand volt insulator, the test of the head would be about 120,000 volts.

It has been my experience in testing insulators that the losses are considerably higher than Mr. Noack states. He gives 2 or 3% as breakage from test. I had occasion to test five thousand 60,000-volt insulators about a year ago. The head shells ran best, with a breakage of about 5%, but the intermediate shells ranged between 15 and 25%. The loss on the complete insulator after it was cemented together was very low, from 1 to 3%. The time of test in my opinion should be at least ten or fifteen minutes. I have tested many insulators for about ten minutes and they showed no defects whatever,

and by running them on the same potential from fifteen to twenty minutes, I would find from 1 to 2% would break down; and I believe the time lag is so indefinite that it is a very good idea to test all insulators from ten to fifteen minutes, especially when they are to be used under severe conditions.

I have a few points of interest concerning the "symmetrical groove" insulator which is of the strain-type, and which is being used in a great many places for suspension work. The ones I have reference to are 10 inches in diameter, the maximum thickness on the outer surface is about 1¼ inches. I took five of these 10-inch strain insulators and put them in series across the terminals of a 3000-volt transformer, and played a shower of water on them. They were arranged horizontally, with a half an inch precipitation at 45 degrees at a potential of 200 kilo volts. With only five of these insulators in series, "brush" discharges began to be apparent, but no actual current leakage; with the transformer we were using we did not deem it advisable to bring up the voltage more than 200 kilo volts under wet conditions. But when we cut the shower off and allowed the insulators to dry, we gradually brought the voltage up to 275,000. At that point there was just a slight discharge over the end insulators. At 300,000 there was considerable leakage on the *end* insulators—that would naturally be true, due to the capacity. At 400,000 volts on a 300 kilo volt transformer, the transformer was strained considerably, and we thought it best not to go any higher. But even at 400,000 volts we did not get any arc-over. That showed up pretty well for the insulators. After we had finished the tests on the series arranged horizontally, we arranged them in a vertical manner, because that would give the operating condition, and used a shower, at 45 degrees, but this time we used three-quarter precipitation a minute rather than ½-inch. Brush discharges became apparent at 175,000 volts, and between 175,000 and 200,000 a severe cracking began to take place; the precipitation was so great (¾-inch per minute) that there was a continuous stream of water from the top insulator to the bottom; so that you can see it was a pretty good bath for the insulators and reduced the arcing distance considerably. It would be very seldom in practice that you would get a continuous stream from top to bottom due to a rain storm. At 200,000 volts they arced over.

There has been some talk of increasing the insulation of lines of 60,000 volts and over by using two of these strain insulators in connection with the insulators which are already installed, by cutting the wire at each pole and inserting such a combination. Of course, with lower voltage systems it would not pay to do this, because the labor expense of cutting the wire at each pole would be prohibitive. But in the case of high voltage insulators, I think it has been contemplated to cut the wire at each pole and put simply a rod or piece of guy wire over the top of the insulator that was already in place, the ordinary petticoat insulator, and on the end of this guy wire place two of these strain insulators, one on each side, and then looping over from one side to the other. In that way you get the increased insulation of the two strain insulators, having the petticoat insulator in series with the two symmetrical, or strain insulators. The only trouble with that would be the place for the loop wire to hang on the top insulator; that is, it would be all right on the two insulators at the ends of the cross-arm; it would simply hang down; on the top of the insulator there would be some trouble. Whether there has anything else been done towards the development of that idea I cannot say.

Some engineers in making up specifications on insulators specify the use of imported china clay, which comes from England, but at the present time a great many of the manufacturers are using a clay that comes from Georgia, which has proven in every respect to be the equal of the imported clays; and it seems to me that it would be a pretty good idea, if any of you have occasion to specify the kind of clay which the insulator is to be made of, that you overlook the fact that this clay is to be imported, because it will cost more, and is no better for the purpose.

In addition to the ingredients which Mr. Noack gave, you might say they use two clays. They use a feldspar, which has a composition which he gave, and then they use a ball clay which gives the composition the proper body; then they use the china clay; so that in reality they use four ingredients, besides using a few other chemicals which I am not thoroughly familiar with. As to firing the kiln, I think most of the potters in Ohio at the present time are using gas. It proves much more satisfactory because they can control the heat much more readily and it seems to give a prettier and more even finish to the ware.

The Chairman. We would be glad to hear from Mr. Bowie on this subject.

A. J. Bowie, Jr. Mr. Noack's remark, with reference to the disposition of the strain on insulators in series recalls a condition which exists in lightning arresters of the multigap type, where the potential is very unequally distributed, with a large number of gaps due to the condensor action. The conditions are undoubtedly the same in insulators. I would like to ask Mr. Noack whether any attempt has been made to measure the strains, the disposition of strains in insulators of that type.

H. R. Noack. Mr. Chairman, these experiments, as you will bear in mind, have only been under consideration during a very recent period, and I believe that the various factories have been satisfied up to the present time merely to note the phenomenon without attempting to make any actual measurement, although that could be done.

A. J. Bowie. Would it not be well to have the insulators near the line?

H. R. Noack. As I explained, the reason for making all the insulators uniform is owing to the fact that in case of any damage to the insulator next to the line the one immediately adjacent to it would be called upon to assume the other's function, and therefore you might consider that you would have to have all the units uniform.

A Member. I notice that glass insulators are being used by one of the power transmission companies, where they are running 50,000 volts over them, with the greatest success; and they have wide variations of temperature, from 50 degrees below to 90 to 95 degrees above; and they are going to 70,000 volts if they have not already gone to it—glass insulators not more than 7½ inches in diameter.

The Chairman. How many parts are there to that insulator?

Member. A single part.

The Chairman. 7-inch top.

Member. 7-inch petticoats. It is really made in two parts, the stem is separate.

H. M. Crozier. That matter of testing insulators seems to be very important. Various points have been brought up. One is that the breakage has been mentioned as high as 25%. In a case like that it would appear to me that the total output should be rejected, because that would mean a test where every fourth insulator was defective. I have had considerable experience in testing in three different factories. In one factory where I was testing the first insulators manufactured in the factory, when they first started in, they had a breakage of 25% in the tops and the centers were a little better. As the factory grew in experience the insulators would give better results, so that we came down to 15% and sometimes 12%. When we got results like that, about 12% breakage, we considered that the factory was giving good results; but the first we rejected completely. In other manufactories the breakage did not get much greater than 10%. I understand that their methods of manufacture have been greatly improved since then, and a breakage as low as 5% would probably be obtained now.

In this matter of testing insulators, it appears to me that while it is very interesting to have an artificial rain upon the insulators, that is a condition that we always considered a good condition. The more it rained the happier we were. We have a condition in the end of autumn, when we had a heavy

fog before the rain, where usually everybody shut down until the power company resumed. That condition in the case of some of these new insulator designs has to be watched very carefully. The factory tests on insulators showing high tension brush discharges and various other things are interesting and may have a great deal of value as far as helping in the designs; but the only final test is to put them out on the line and see what the dust and fog will do.

In regard to the tests, I agree exactly with Mr. Jones with regard to the centers. The centers as a rule would show a little higher breakage than the top. But there is another thing that has to be watched, and I do not agree with Mr. Jones at all in regard to it,—length of test. If an insulator would stand up for a minute, it is a good insulator; that is, it has been fired so that the material has been thoroughly vitrified. A long test has a very slight effect on it, but if the material is not thoroughly vitrified, the longer test begins to have some influence. A matter of fifteen minutes test on insulators would usually tie the factory up so much that it would begin to have an important bearing on the cost. The best way to tell that is by the color of the brush discharged, and also by the color of the insulators; and usually you can tell the insulators that are not thoroughly vitrified by it. Of course, the inspectors have to get that by some months of testing.

A. G. Jones. The insulators on the long test that I referred to were going to India, and I thought it was a good thing to give them as severe a test as possible. It is true that you can pick out the insulators by the color; but some factories use so many different colors of glaze that if you cannot get into the body you cannot make this test. Another thing: They may be over-fired. We had a great deal of trouble with insulators that were over-fired as well as those that were under-fired. That is hard to tell except by the glaze. The glaze shows up the over-fire better than the under-fire; and I think it is a good thing to test them about ten minutes, unless as you say, it increases the cost to the factory and therefore the cost to the company; but if I had anything to do with insulator specification, I would require that they should have at least a ten-minute final test.

H. M. Crozier. The test I am speaking of is the test on the single shells. I do not think the complete insulator test has any value at all. If the tests on the parts are sufficiently complete to test the material, I do not see that the tests on the complete insulator has any value except the laboratory one. I do not think it should be tried either on a complete series on a line. In the first start it is a good idea to run through 100 or so for the complete test, but I cannot see that the test on the complete insulator has any value after the first one.

Another point about testing insulators. I notice a great many insulators will go through and stand the electrical test, and if you take those same insulators and soak them in a barrel of water over night, the next day they will break down. The insulators were not thoroughly vitrified, and that can only be determined by thorough inspection. In one of the first lines that I made tests on, that is, the Kern River line in Los Angeles, I am almost positive that at first I passed a good many of the inner shells that were not thoroughly vitrified. However, when the line was completely assembled, we lost only two insulators in 200 miles of wire.

Thomas Anderson. Did you test these insulators all dry?

Mr. Crozier. No water at all, except when we made these tests in regard to vitrification, when we used to put them in a barrel of water and try them the next morning.

S. B. Charters. I would suggest that in using the long-time test of insulators, it may be very satisfactory to the line constructor, but not to the manufacturer; because in subjecting an insulator to those long strains, if there are any porous places in the insulators there is air in them, and the air will cause a corona to form, and we have a continuous action of minute arcs in the mass of the material; so that under continuous strain we shall have a breakdown in time, which would momentarily pass. The extraordinary strains are only momentary. It is a hard tax on the manufacturer. That is a point which may be settled between the buyer and the manufacturer. I had an instance where we tested a number of insulators to 185,000 volts. They were special insulators, all mounted when they came in, and they uniformly failed. It was a great disappointment; but the manufacturers in going over the matter found that the trouble was the man who assembled them had painted the pins with metallic paint. When that was removed, the insulators passed all right. I was talking about that a moment ago, but we did not settle the point between us. This point came up, that while the insulator did not show a breakdown, a small insulator of that kind might show a continuous loss on the line. I have in mind an insulator built up of glass and porcelain together. That insulator will stand without any difficulty a strain of 60,000 volts as far as puncture or leakage goes, but at the same time there will be formed a corona or light blue discharge. That is an evidence that the air has broken down around the insulator; in other words, the potential is a degree too great. That will, of course, wear the insulator away. If it is small, it will take a very long time. That is a serious item on the line, because at such discharge there is a loss occurring which constitutes a constant leakage on the line; and while these small insulators may be satisfactory, yet there is due to it a very serious leakage in a long circuit.

H. G. Jones. Is that real power?

S. B. Charters. That is real power; it consumes real power. Whenever you have this corona formation and as soon as you have a visible corona your curve goes up suddenly, giving you an increase in line loss, with a small increase in pressure.

Member. That leakage takes place, because at night you can see the leakage. You can see nothing whatever on these glass insulators. At 60,000 volts it would heat the glass up to that it will break, of course; but they have nothing of that kind. Their insulators are especially designed for them. I think some of the engineers connected with the company designed them. They followed out the rule of making all the sections of the insulator uniform, so that there would be no liability to expansion and contraction. I have seen them take those insulators covered with ice in the winter time, and put them on the stove, and thaw them out so that they could put them on the pins. They did get a few breakages.

S. L. Foster. We have heard a description of insulators; they have told us that the outside of the insulator is not to be considered at all, because it becomes wet. We must figure on the inner surface, on account of the dust and fog conditions we have here in San Francisco, which cause burned-off cross-arms, and burned-off pins, and the rain washes the outside; it does not wash the inside; it is still covered with dust. Why is it that the washing of the outside removes our troubles?

H. R. Noack. In the face of a practical question from a man like Mr. Foster, that is a stunner. However, you might consider that after the rain had occurred, washing off the dust and dirt deposits upon the outer surface, and the rain then disappears, you have got remaining your clean dry surface, which would be an effective medium against leakage.

S. L. Foster. But the following fog does not cause any more trouble. We have to wait a year for more trouble.

H. R. Noack. I will have to think that over.

C. W. Hutton. Mr. Jones stated that some of the Eastern factories were thinking of increasing their line resistance by adding two insulators suspended at each pole and then cutting their cable, and putting a jumper on that. The two sets of insulators are in parallel. To have a good insulation you would have to use twice as many discs. Cutting the cable and putting a jumper around would be excessive in cost compared to putting an extra arm in order to get the disc to be suspended, and then half the number of discs would give you the same insulation. I suppose they could use the old insulators as against the other way. I hardly see why that would not be rather an

expensive way to change the line to increase the installation.

A. G. Jones. The same insulators are made in quite a larger size than the ten inches I have referred to; and of course you would not require so many in series as you would the smaller diameter. And whereas I do not know that any special plant was figuring on making the change, I notice the engineers have been figuring on the recommendation; whether they have submitted the recommendations I do not know. I made tests myself on the various combinations, and it seemed to be very effective indeed, and I have the figures with me. They show the exact data on the increased insulation due to that combination, and it has really very much increased the insulation. It would not be economical on lower voltages. Only on the higher voltages would it be economical, because when you get up to sixty or seventy thousand, you can no longer use the petticoat insulators. But by placing one of these combinations on each pole you could go up to 100,000 volts or more. Of course, these are only suggestions.

H. Y. Hall, Jr. It does not mean any reconstruction of the line; only a re-arrangement of the insulators.

Thomas Anderson. On a test I had something to do with, we had about ten different makes of insulators, and out of all our glass insulators, with the exception of the two-part insulators, we never had a breakdown. We went up to 80,000 volts. It was during the winter season and we had all kinds of weather, very bad weather part of the time, and we never lost a glass insulator; but on the two-part glass insulators we lost quite a few—I forget the percentage.

S. B. Charters. What I spoke of were part glass and part porcelain. There were a lot of them used afterwards. We put them on 33,000 volts and in dry weather they stood very well. Part of the line ran through a dry country and part through the wet. We had all kinds of trouble with the line through the wet country.

The Chairman. There will be no question but that the art of manufacturing insulators has progressed a great deal in the last few years, but there is considerable room for improvement. We have heard about glass and porcelain, but I think that Mr. Foster's remarks are very much to the point. If we could get an insulator that would be entirely exposed to the rain and weather and conditions similar to the severe test—so-called severe test—that are put on them in the factory, we would welcome it. We all know that the most vital part of any transmission system is the insulator, and that today is the limiting factor in the high voltage transmission. Were it not for the weak point of insulators, voltages today would be very much higher than they are. As for insulators breaking down due to leakage, when wet in the rain, that is to my mind of more or less minor importance. As Mr. Foster says, when you have a year's accumulation of dust on those insulators and you have a fog or drizzling rain, that is the time that you can expect trouble. If you could go out and turn the hose on the insulators and give them a good cleaning off, your troubles would be reduced to a minimum. That is a thing the transmission companies have to contend with more than the insulators puncturing.

Thomas Anderson. Do you have any trouble with these lines here on account of salt fog.

The Chairman. Yes, but the same insulator that Mr. Charters referred to as showing a light blue halo around the top at high voltages have worked very satisfactorily at 60,000 volts, and are working at these volts today.

Thomas Anderson. Subject to these fogs?

The Chairman. No. Those are in districts where there is comparatively little fog and where there is less dust than in the more thickly settled districts and around the bay. As for any leakage or any loss of power due to that halo which you notice on the insulators that is negligible, you cannot notice it. I think that is due more to climatic conditions than anything else. There are certain times or certain seasons when you will see that very clearly, it will be very noticeable, and other times you will not be able to notice it at all. The change in load on any line with and without the halo is not noticeable. I think Mr. Jones was correct in stating that that was a wattless current, if it was a current, and not a current which represented any appreciable amount of power. Mr. Jorgenson, have you not something to say on this subject?

L. R. Jorgenson. In order to increase resistance against puncture, the insulator is divided into several pieces, and these several pieces cemented together on top of each other. The total voltage between the wire and pin should divide itself equally between the different petticoats. This, it will only do if the different pieces are of the same thicknesses, and what is more important, if the cement coat between them covers the same area on all pieces. The cement coat forms a conducting cap, or at least it must be assumed to be conducting, around the top of the insulator, and it gives the static flux an opportunity to distribute itself on the surface of this coat uniformly. If all the areas of these conducting caps are made the same, the static flux density will be the same and each petticoat will take up its share of the dielectric strain. The height or depth of this conducting cap will be the greatest between the pin and the inside petticoat for the simple reason that the diameter is the smallest and it will be the least between the outside shell and the next petticoat, because here we have the largest diameter. This is a rule that is not always complied with as it should be. The area of the cement cap between the pin and the inside petticoat is often made the smallest, and sometimes the cement is left out entirely, the insulator being dropped loose over the pin. In this case the voltage would not distribute itself equally among the different pieces, and the inside petticoat would be strained the hardest. In case of a failure, this inside petticoat would puncture first, and show the largest puncture crack. The resistance to creeping should also be distributed equally among the different petticoats. This is probably not so important and is difficult to accomplish, for the simple reason that this creeping is an uncertain quantity, depending mostly upon the cleanliness of the surface. In order to compare the creeping resistance of the different petticoats, it is convenient to choose a standard unit for creeping resistance. Take, for instance, the resistance to creeping on the surface of a plain porcelain cylinder five inches in diameter and one inch long, and call it one. Then it stands to reason that a cylinder ten inches in diameter and one inch long would have a creeping resistance of one-half, because the area is double. This would hold true at least if the surface were slightly dirty and wet. From this it follows that a bushing or petticoat of small diameter has a much larger creeping resistance than one of large diameter, the length being the same. The large outside shell on a high voltage insulator will not offer much resistance for creeping, on account of the larger diameter, unless it is provided with corrugations on the lower side. But this large diameter is necessary to provide against surface arcing between the wire and the pin. On the new type of suspended insulators the large diameter shells are not needed to take care of the arcing, even for very high voltages, as several insulators are connected in series, necessitating a larger distance between the wire and cross-arms than absolutely necessary to prevent flashing over. With the smaller diameter of the shell, the creeping surface can be made large enough with much less material, resulting in a considerable saving of porcelain. It is therefore probable that for lines with voltages of over 60,000 the insulators will not be along the lines of the old style, except on poles carrying a single transmission line. The insulator for the top wire could most cheaply be supported on insulators mounted on pins and the two outside wires mounted on insulators of the suspended type. Mr. Baum has invented an insulator to be used for the top wire of a single transmission circuit. It consists of a standard 75,000-volt insulator, with a corrugated bushing

cemented on top. This bushing will stand 50,000 volts. It is supposed that a rainstorm will clean the bushing before the inside petticoats become wet, and the whole combination should be safe on lines carrying 100,000 volts.

The Chairman. Mr. Adams, have you anything to say on this subject?

C. F. Adams. In connection with the matter of insulators, I have noted the general description of the growth of the insulator, and the illustrations which we have covering the various types of insulator in use on the system illustrate the points that have been brought out by the various speakers. In connection with the use of insulators under extreme conditions, I believe in our practice we jump from fourteen inches to a sixteen-inch type, with a corrugated surface underneath. That was the first move. Under extreme conditions this failed and we went from that to larger corrugations, extending at least two inches below the main body of the upper shell, and this failed. An attendant who had an idea and got busy with a little can full of transformer oil and waste, wiped all those insulators off that were giving trouble. Since that time we have never added any more corrugations to the insulators. In other words, the permanent insulator under all conditions is an impossible thing to manufacture. An insulator has to have attention; it has got to be kept clean; and under conditions of extreme service, there is nothing which fills all conditions except parallel lines, one of which can be occasionally shut down and cleaned. In a later type of insulator there are two or three things which have been considered that have been slightly touched upon tonight. The suggestion has been made that the inner shell is possibly the weakest on account of the stress. As a matter of fact, in proper line construction, where all of the weight of the line is borne by the insulator and there is no upstrain, there is no need of a threaded insulator. Another point which was a little touched upon: that is to say, the relative position of the various petticoats. There is one feature which has not been fully brought out that is quite important, and that is this: Each shell of the petticoat acts practically as a condenser, and where your shells are close together, as they are in many designs of insulators that you will find, the discharge will be between adjacent shells of the insulators. This is overcome by a wider separation of the shells, and it results in a very appreciable decrease in the brush discharge effect in the insulator itself. As to the effect of the brush discharge as affecting the load of the system, I read very carefully Mr. Mershon's article which appeared some time ago, relating to the effect of high tension, and I also have a series of curves and data prepared by the Stanley Electric Company's engineer some three or four years prior to the Mershon test. While none of these tests were made in connection with any load on the system, in all cases the actual load, the actual charging current of the wire, went up as the carrying voltage was reached. In other words, when your lines and your insulators commenced to become luminous after dark, your curves began to go up. I do not think that that effect would be enough to appreciably affect the readings of the ordinary heavy station instrument in use, but in connection with a pure test as to the actual power used on insulators and on lines, it certainly is a quantity.

The Chairman. A fool suggestion was at one time made that if every insulator could be housed and kept away from the rain, dust, and dirt, we would have an ideal line. That suggestion was followed by another one that they could be housed to best advantage by taking an ordinary washtub and inverting it right over the top of the insulator. You would have the insulator protected then from the small boy with the rock and the large boy with the shotgun, and there may be some merit to a fool suggestion of that kind for this reason: There is no question but what insulators will fail, more often where they are exposed to the wind. The reason of that is this: The wind will strike the lower petticoat, and any dust that may be carried will be deflected up underneath and it will accumulate there, and when the fogs come it will get wet. If you have a driving rain the rain will be driven up under there, and the result is you have a leakage over that insulator and the consequent breakdown of that insulator.

A. S. Kalenborn. In connection with the insulator of Mr. Foster, since he wants the insulator washed all the time, when the discs were strung along in a horizontal line we were told that they stood the test much better than in a vertical manner, and I think the solution would come there. They found that they could run the voltage up to 300,000 when they were placed horizontally, and only 175,000 in a vertical manner.

A. G. Jones. Four hundred thousand horizontally.

A. S. Kalenborn. If you make all the discs flat, the rain can get over the top and wash the dust off the bottom, although you would have twice the number as you would have if you had them suspended underneath.

A. G. Jones. I think that plan has already been pursued.

A Member. (Following the discussion:) We had a case two or three years ago that happened down in Santa Cruz County. The power company operated a transmission line there of eleven or twelve miles. It is now operating at 11,000 volts and the original insulator was the No. 2 Troll. This line runs right along the coast within an average of 500 feet of the ocean. It is also along the county road, where it is very dusty. The dust seems to get in the petticoats of the insulators, and it is very foggy there in the evenings, and we had quite a number of breakdowns. The suggestion was made and carried out that these insulators be boxed underneath with a wooden box on the crossarms that would protect the petticoats. That did not seem to work very well, and I suppose it was due to the fact that the box brought the crossarm within an inch or so of the wire.

Another case came up there. As I say, the Troll insulators did not prove very satisfactory and were being replaced. The construction crew ran short of high-tension insulators; they had nothing but a few of these ordinary telephone insulators. They put one of those on the high-tension lines, 11,000 volts. I think that insulator is there today.

C. W. Burkett. I have a dim recollection of what Mr. Vincent told me about a number of tests he made.

W. G. Vincent. I made some tests on a bluff just above Santa Cruz on the Ocean Shore Railway. The tests were not as complete as they might have been, but we decided that the insulator was the best where it had as few chances as possible for the dust to settle down upon it. I think the explanation of Mr. Foster's question is that the dust settles on the insulator and the fog forms a kind of connection between the small particles, and then, when you get a heavy fog in the fall, that gets moist and causes trouble. The underside is dry and the dry side is washed off by the rain and you are through with trouble from that on. I think the suspended insulators would be very good indeed.

C. W. Burkett. I would like, just as a matter of information and curiosity, to ask if any one present has ever heard tell of or knows anything about an oil insulator. I suppose to a high-tension man this appears ridiculous, but I am wondering if such a thing has been thought of.

S. L. Foster. That was tried out in the earliest days, and the judgment was that insects would fill it up.

A Member. Did they not use a lot of oil insulators down South?

H. R. Noack. I remember seeing a lot of oil insulators used up near Oregon City years ago. There are some I think still in use, although, as Mr. Foster says, the oil insulator becomes full of dirt and dust and becomes ineffective.

H. N. Crozier. I remember seeing a lot of those down in Los Angeles. I think they were used on that original 10,000-volt line.

A Member. No, that was a plain glass insulator.

H. M. Crozier. I remember seeing them down in Los Angeles.

S. L. Foster. About the still-air space: We had trouble with our lines going down toward San Mateo. We had some burn-outs this summer on the lea side of the pole and we just transferred the circuit onto the weather side of the pole and had no more trouble. When the circuit was transferred from the lea side of the pole to the weather side, the trouble stopped.

VALUE OF FLUE-GAS ANALYSIS.

In a recent boiler-plant test made by the Coal Department of The Arthur D. Little Laboratory, Boston, the loss due to unburned gases from a thick, uneven fire, was illustrated by an interesting occurrence in connection with the flue-gas analysis. The test showed the following relative conditions:

	1	2
Sample of Gas Taken.	**5:00 P. M.**	**5:30 P. M.**
Carbon dioxide, CO_2	11.3%	14.3%
Oxygen, O_2	6.5%	5.5%
Carbon monoxide, CO	2.4%	0.0%
Nitrogen, N_2	79.8%	80.2%
Air excess	45. %	36. %
Temperature flue gas, F.	545°	700°
Heat lost, due to CO	9.7%	
Heat lost, due to increased temperature of flue gas		4.3%

The first analysis shows a considerable amount of CO to be present. Before taking the next sample, the CO started to burn through the passes of a 600-horsepower Aultman & Taylor boiler, and the CO was being entirely consumed. The flue temperature rose 155 degrees on account of the burning of the CO through the passes of the boiler instead of in the furnace. There was no combustion chamber, and the fire was so thick that it came close to the bottom row of tubes.

A number of points can be drawn from this instance:

(1) Had the boiler been set with an ample combustion chamber, all gases would have been burned before coming in contact with the heating surface, resulting in a gas analysis like No. 2, but with a temperature corresponding to No. 1.

(2) The fire should not be carried so thick that CO will be formed, as it is very difficult to burn it all in a boiler furnace when once formed, and the loss due to small percentages of CO is very great.

(3) The determination of CO_2 alone is not sufficient to determine whether the boiler is being properly fired. In the case of No. 1 sample, a CO_2 indicator should have shown 11.3% CO_2, which would ordinarily have been considered very good, but there would have been no indication that CO was present, while the loss due to it was as great as if the CO_2 had been only 7.5% with no CO.

WATER POWER FOR THE BOSTON AND MONTANA SMELTER.

A considerable portion of the power to be made available by the development at Great Falls, Mont. will be used by the Boston & Montana smelter. The development, which is beginning to take shape in accordance with plans by Chas. T. Main, engineer, Boston, Mass., will comprise two powers. The upper at Coulter's, Crooked, and Rainbow Falls, three miles down the river, will include a 25-foot crib dam with masonry head-gate and waste-gate structures. A steel penstock 22 feet in diameter will conduct the water 2500 feet to the power house. The dam at the lower development, 12 miles below Great Falls, will be of the same construction. There will be a canal about 500 feet long, below which will be the power house. At both developments the head will be over 100 feet, and at each a 30,000 horsepower equipment of wheels and electrical apparatus will be installed. Mr. Main has already organized his engineering corps which is now busily engaged in making surveys and preparing plans. Work on the coffer dam has begun; it is expected to rush everything through to completion at the earliest possible date.

CIVIL SERVICE EXAMINATION.

The United States Civil Service Commission announces an examination on November 16-17, 1908, to secure eligibles from which to make certification to fill a vacancy in the position of assistant (male), at $1,000 per annum, in the Naval Observatory, Navy Department, Washington, D. C., and vacancies requiring similar qualifications as they may occur.

FAN POWER TESTS.

The report of a series of tests of an exhaust fan, conducted by Prof. Charles H. Chase, at the engineering laboratories of Tufts College, presents some interesting facts. The object of the test was to show the difference, if any, between the power required to drive a fan equipped with the ordinary form of babbitted bearings and one provided with ball bearings. For the purpose, there was taken from the regular stock of the Massachusetts Fan Co. one of their standard ball-bearing exhausters. This was provided with an interchangeable set of babbitted bearings, so that tests could be conducted with the same wheel and casing, the only difference being in the bearings.

The casing was 35 inches high by 13¼ inches wide, the wheel being 24 inches diameter, of the "long-shaving" planing-mill type without side plates. The fan was run at various speeds ranging from about 900 up to 1,900 revolutions per minute. Various areas of discharge were provided by means of tapering nozzles attached to the outlet. These were graded from the smallest, having about three-fourths the capacity area of the fan, up to the largest, with double the capacity area. According to the area of outlet, the pressures at the highest speed ranged from about six ounces down to about 3 ounces per square inch. The power ranged from about 1½ horsepower with the smallest outlet at the lowest speed, up to 13 at the highest speed observed (about 1680 revolutions) with the largest outlet.

Throughout this range the ball-bearing fan showed decided superiority, the average saving in power being 8.3 per cent as compared with the babbitted bearing type; at low speed it ran up to about 11 per cent.

The actual power with the babbitted bearings under working conditions at a fairly high speed corresponding to about 6 ounces pressure, was about 12 horsepower. A saving of 8.3 per cent on this particular fan would therefore mean about one horsepower. As a ball-bearing fan of the type tested can probably be bought for about the price of the ordinary type—possibly a little more—the saving is practically clear. It would undoubtedly be sufficient to pay for the fan in less than two years.

MEETING OF THE A. S. M. E.

The November meeting of The American Society of Mechanical Engineers will be held in the Engineering Societies Building, 29 West Thirty-ninth Street on Tuesday evening, November 10th. Mr. Franklin Phillips, president of the Hewes & Phillips Iron Works, Newark, N. J., will make an address on "The High Powered Rifle and its Ammunition—Instruments of Precision," illustrated by lantern slides. Mr. Phillips is an expert marksman, and in 1903 won the position as first alternate on the International Rifle Team to England. He was for many years chairman of the committee on Rifle and Pistol Practice in the National Guard of New Jersey, and is now Ordnance Officer of the Second Infantry of that State. Tests of rifles and ammunition at Sea Girt, N. J., by men connected with the New Jersey National Guard have led to marked improvement in arms and ammunition and to an entire change in the powder used by the Government, thereby greatly increasing the accuracy of the shot. The improvement has been extended to large guns, and instead of 2 per cent hits which were made at Santiago, 80 per cent is now the average in some ships. Mr. Phillips has actively participated in this work, and as he is primarily a mechanical engineer, as well as a marksman, he will explain to his audience the practical bearing of his investigations upon the construction of arms and the elements entering into ammunition.

ATTITUDE OF THE LAW TOWARD ELECTRICITY.

By Emerson W. Read,* B. L., LL. B.

Perhaps more damage occurs to individuals through an electrical company's wires than any other apparatus or agency of that company. Negligence on the company's part is not always proximately the cause of such damage. Windstorms, falling trees, lightning, and numerous other causes and forces over which an electrical company can have no control very often tear down wires, as a consequence of which personal injury follows. In a damage suit arising out of an accident resulting from one's coming in contact with wires torn down during a storm, under certain circumstances well known, the facts of the storm and the impaired condition of the wires may be used by the defendant company as a good and sufficient defense. No company can be charged with notice of impaired wires immediately after the storm tore them down. A reasonable space of time must elapse, dependent on the locality of the wires, distance from power centers, etc., before knowledge of the destruction of the wires can be expected to reach the company. But it is a duty of the company to use due diligence to receive information of the condition of its wires, and a failure to exercise such diligence constitutes negligence. (Mitchell v. Charleston Light etc. Co., 45 S. E. 146.)

The slightest intimation of defects in an electrical company's wires is sufficient to charge such a company. This follows directly in consequence of the dangerous nature of the company's business. Direct and express notice of a defect need not be had an a company; it is enough if the defect has existed for such a length of time that the company should have known of it. (Fitzgerald v. Edison Elec. etc. Co., 200 Pa. St. 540.) In that decision Mitchell, J., says: "But the duty is not only to make the wire safe by proper insulation, but to keep it so by constant oversight and repair. Appellant at the trial offered to show that this had not been done, that the insulation had been defective for several weeks, as had been shown by the 'spitting fire' when blown against the corner of the roof. . . . The plaintiff is not bound to show direct and express notice of the defect, but may show that it has existed for such a period of time that it ought to have been known to the authorities."

Griffin v. United Electrical etc. Co. (164 Mass. 492) holds that a company is responsible for an abrasion in an insulated wire that has so existed for a considerable length of time, on the grounds that the company will be presumed to know its condition. In the course of that decision the Court, speaking through Lathrop, J., said: "While an expert may consider it dangerous to touch any wire, unless he knows it to be a dangerous one, there was evidence that the plaintiff was not an expert and did not know that electric light wires ran on the sides of buildings. . . . There certainly was evidence that the insulation of the wire was gone, and its condition was such that the jury might have found, from the description given of it by the witnesses, that it had been in that condition for such a length of time that the defendant ought to have known of it. The plaintiff was not a trespasser or a mere licensee who must take the premises of another as he finds them. He was rightfully on the premises for purposes of business. On these premises the defendant had rightfully placed, as the case finds, two electric wires. These were a source of danger unless proprly insulated. This fact was recognized by the defendant by insulating them. But it was negligent if it failed to use reasonable diligence in seeing that its wires were kept in a state of repair. This duty it owed at least to every person who, for purposes of business, was rightfully upon the premises."

*Member of the San Francisco Bar.

While it may be noticed that some of the quoted passages in these articles may not seem to bear directly upon the particular phase of this branch of law dealt with in the various articles, yet they most competently show the manner of dealing with cases employed by judges who themselves are not experts in the electrical science. The expert may view these matters quite from another point of view from that assumed by the judiciary. Much of the lawyer's art is the ability to anticipate the view courts will take of certain facts arising under certain circumstances. To know the method of reasoning employed by courts is very necessary, both for lawyers and laymen, and these methods are best seen through the reasoning shown in reported decisions. The language of one precedent largely shapes the action of subsequent courts.

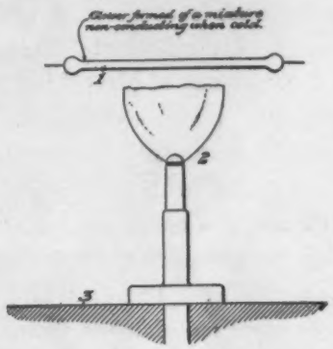
A striking instance of gross negligence on the part of a company is that shown in Texarkana etc. Elec. Co. v. Orr (59 Ark. 215). The action was one to recover for death caused by the company's negligence. A severe storm had swept the wires of a gas and electric light company from their fastenings and caused them to hang into the street of the municipality. Two hours after they had fallen information reached the company's offices informing the company that the wires were down. Regardless of this fact, the company continued to keep power on for another four hours, at the end of which time the accident complained of occurred. In rendering its decision in favor of the plaintiff, the Court said: "There is evidence of wanton disregard of the rights and safety of others on the part of the defendant's employees."

Numerous cases might be cited to the effect that electric companies must promptly remedy breaks or defects in its wires occasioned by defects or accidents. To allow an impaired wire or system of wires to remain in a dangerous condition is prima facie evidence of negligence, subjecting the negligent company to liability in case of accident arising therefrom. But in cases where accidents arise entirely beyond the control of the company whereby wiring is rendered defective and dangerous, if the company acts with promptness and diligence it may exonerate itself from all blame and responsibility. The Court, in the case of Read v. City etc. Electric Ry. Co. (115 Ga. 366), held that the company had complied with the rules of law relative to diligence. There the defendant company's overhead trolley wire was caused to sag by the weight of another wire which had fallen from above onto it. The defendant had immediately taken proper steps to prevent the wire from injuring passers-by, and the Court held the defendant to have been as reasonably diligent and free from fault as the law could exact.

Presumption of notice is fairly explained in Mitchell v. Raleigh Elec. Co. (129 N. C. 166). "There is no evidence to show that intestate so managed or mismanaged his wire as to cut through the insulation of defendant company's wire, nor is there any evidence to show that the abrasion in the insulation was seen, or by due care could have been seen, by him. In extent, the evidence shows that it varied from the width of a pencil to two inches, and was suspended thirty feet above the street. It does appear that his wire came in contact with, and rested upon, the electric wire, but there is no evidence to show that it caused the abrasion in which it rested, nor was there any evidence to show that he knew of its existence. The fact that it was there, and had been there for two years, and had been seen and known to exist there for two years by at least two people, the Court must presume that it was or ought to have been known by defendant company. So where an electric light company permitted a live wire to remain on the surface of a street for three weeks, and a traveler was injured by contact with such live wire, it was held that the Court could presume, after such a period, that the company had notice of the fact."

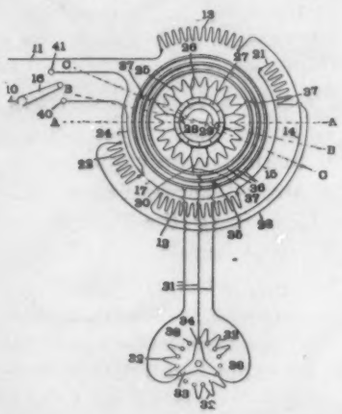
PATENTS

ELECTRIC GLOW-LAMP. 900,416. Walther Nernst, Gottingen, Germany, assignor by mesne assignments, to Nernst Lamp Company, Pittsburg, Pa.



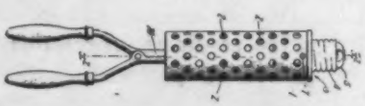
An improved glower for electrical incandescent lamps which is a non-conductor at normal atmospheric temperatures but which readily becomes conductive and incandescent under the action of an electric current when heated, comprising a mixture of zirconium oxide with thorium oxide.

ALTERNATING-CURRENT MOTOR. 900,478. James H. Bryson, St. Louis, Mo., assignor to Wagner Electric Manufacturing Company, St. Louis, Mo.



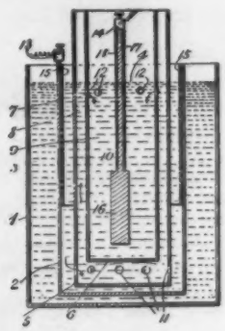
In an electric motor, the combination with a pair of relatively rotatable members, of means for producing definite poles in one of said members, and a pair of windings for the other of said members, one of said windings producing poles at one side of the poles of said first member, and the other of said windings co-operating with all of said first windings to shift said poles to the other side of the poles of said first member.

ELECTRIC CURLING-IRON HEATER. 900,292. Wynn Meredith, San Francisco, Cal., assignor to Pacific Electric Heating Company, Ontario, Cal.



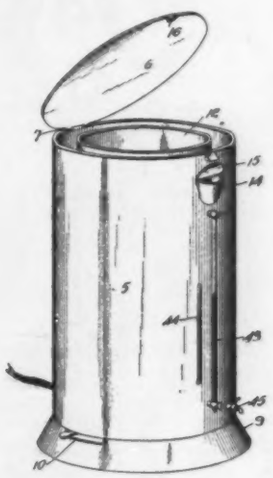
An electric curling iron heater comprising a tube adapted to receive a curling iron, a heating wire wound close to the tube, a thin electric insulation between the wire and tube, a thick heat insulation around the heating wire, a perforated shell surrounding the latter insulation with an air space between the shell and said insulation, a ring of insulation supported at the lower end of the shell, an insulating cap at the other end of the shell at the inner end of the tube, and washers encircling the tube at each end and fitting the shell for holding the tube concentrically in the shell.

ELECTROLYTIC ALTERNATING-CURRENT RECTIFIER. 900,278. Arthur S. Hickley, Manasquan, N. J.

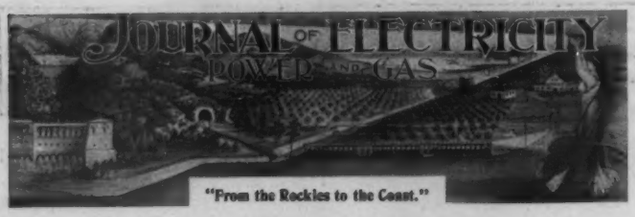


An electrolytic alternating-current rectifier having insulating members extending into the electrolyte and above the cell for protecting the terminals against short circuiting, and an electrolyte containing glycerin for preventing oxides and precipitates forming and collecting in the cell.

ELECTRIC HEATING DEVICE. 900,295. William C. Mortensen, Salt Lake City, Utah, assignor of one-half to Joseph R. Harris, Woodruff, Idaho.



An urn of the class described, comprising a cylindrical vessel having a lower slotted flange, an open ended cylinder secured to the bottom of said vessel to form a heating chamber, a lid to close said vessel and chamber, an upper and a lower lamp supporting bar within said chamber, electric lamps secured to said bars, a switch pivoted to the undersurface of said urn having an operating handle extending through said slot, an electric terminal for each lamp in the path of said switch, conductors connecting said lamps and terminals, and conductors within a suitable circuit connected to said lamps and switch.



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NOTICE TO ADVERTISERS

Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday for the paper dated Saturday of the same week. Where proof is to be returned for approval, Eastern advertisers should mail copy at least thirty days in advance of date of issue.

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CLEAN IT NOW.

It would be a paying proposition for central station managers to distribute broadcast among employees and consumers alike a printed card bearing the admonition

CLEAN IT NOW.

There is more money lost annually in the power business because of dirt, than is saved in the sweepings of the United States mints. Dirt may be only "matter out of place," but it has proved rather costly matter in many instances. In the office such a card would continually remind the owner of a desk which is covered with useless papers that disorder and dirt are not conducive to effective work. But it is along the power line particularly that these cards are most needed. There is probably no field where dirt does more real damage than in the generation, distribution and utilization of electricity.

Along one of our western high tension transmission lines that traverse a dusty region subject to frequent fogs, there is likely to be considerable creeping on the insulators. For a time increase in size and in number of corrugations failed to prevent this, until finally an attendant conceived the brilliant idea that a handful of waste and a can of oil would clean off the dirt and thus eliminate the creeping. Since that time no more corrugations have been added either to the insulators or to brow of the manager.

Investigation of a recent disastrous explosion in the receiver of an air compressor showed that it was caused by the heating of an explosive mixture, resulting from a neglected accumulation of oil and dust. A little care in keeping the machinery clean would have prevented this explosion. Many transformers are running hot because the oil has not been properly looked after. Filtering is often all that is necessary to clear the oil of carbonized matter and allow cool running. Innumerable instances of burned tubes and of poor boiler economy can be traced to scale incrustation. With the efficient scale-removers now on the market there is little excuse for such neglect. Dirty commutators cause sparking and chattering of the brushes of motors and dynamos. Cleaning the commutator will cure this. An electric light is often condemned as poor when a vigorous scrubbing of the globe and lamp would increase its brilliancy.

That these and many similar abuses exist is due not to ignorance but to carelessness. The veriest tyro in the business knows how disastrous dirt may become, even as his supine indifference allows it to gather until too late. Cleanliness is largely a matter of habit. Dirt is the result of procrastination. What is there to be gained by postponing something that should be done at once? Apparatus neglected is apparatus that will fail in an emergency. In other words, never put off till tomorrow the cleaning that should be done today.

THE ELECTRICAL CLUB.

With the steady expansion of the electrical business in San Francisco, has developed an ever-increasing sentiment toward the organization of an electrical club, with the object of bringing those engaged in the electrical business in closer contact socially, and providing a meeting place for the various bodies affiliated with the electrical interests. This feeling has recently crystalized and taken shape, and an electrical club has at last become an assured fact. The form of the organization was completed during the past two or three weeks, and includes some of the principal electrical people of the city. The officers elected are as follows:

Mr. Henry F. Frosch, President.
Mr. Arthur E. Rowe, Vice-President.
Mr. R. D. Holabird, Secretary.
Mr. E. D. Poss, Treasurer.
Mr. F. H. Poss, House Committee.

Mr. F. S. Mills, together with the above officers, constitutes the Board of Directors.

Until some permanent headquarters are arranged for, the club will meet regularly at 1 p. m. each Saturday, in the Beefsteak Room of the Bismark Cafe, at Fourth and Market Streets, where luncheon will be served, followed by talks on subjects of interest by different members. It is intended to make this a permanent feature of the club, and arrange for talks by prominent members of the electrical fraternities, the subjects to be selected in advance and to cover information and data which will be of value.

The Entertainment Committee is arranging for the production of a musical comedy, which it is hoped can be placed upon the stage at an early date, with the object of raising funds to cover such expenses as the operation of the club will make necessary.

The club as now organized includes a number of members talented in both a musical and dramatic way, and there is no question but what an entertainment of this kind can be successfully handled.

It is hoped that those affiliated with the electrical business will take an interest in this organization and without further invitation attend the future meetings and lend their support in making the club a success.

PERSONALS.

A. S. Kalenborn is now with the San Francisco office of F. G. Baum & Co.

Carl Bush, manager of the telephone department of the Western Electric Company at Seattle, spent several days in San Francisco during the past week.

H. P. James, formerly electrical engineer of the Bryant Electric Company, now occupies the position of sales manager for the new line of push-button specialties recently placed on the market by the Cutler-Hammer Manufacturing Company, of Milwaukee.

The many friends on the Pacific Coast of Mr. E. W. Rockafellow, supply sales manager of the Western Electric Company, with headquarters at New York City, will be unusually glad to hear that he has recovered from an illness extending over several months and again resumed his duties.

Mr. H. B. Squires, of Otis & Squires, of San Francisco, accompanied by Mr. A. W. Vinson, resident engineer for the Cutler-Hammer Manufacturing Company, of Milwaukee, left on October 20th for a trip of six or eight weeks, during which they expect to cover the entire Northwest, in the interest of the Cutler-Hammer Manufacturing Company and other manufacturers represented by Otis & Squires.

Mr. W. L. Goodwin of the Sterling Electric Company, San Francisco, left during the past week on a vacation trip of two or three weeks. He has "taken to the woods," where he hopes to recuperate from the past few months of strenuous work in connection with his company. Mr. Frank J. Quinn, Treasurer of the Sterling Electric Company, reports that since Mr. Goodwin's departure business has taken on quite a boom, but he does not consider that Mr. Goodwin's absence has anything to do with it.

TRADE CATALOGUES.

Catalogue Eleven from the Welsbach Company gives illustrated descriptions and prices of mantles and fixtures for incandescent gas lighting. It is handsomely bound in green cover, printed with black and gold.

Bulletin No. 5910-8 from the Western Electric Company contains valuable data on Electrical Equipment for Mines. Special attention is called to their Type "E" ore separators for the magnetic concentration of ores. Illustrations are also given of power and lighting equipment.

Catalogue No. 1 from Drendell Electrical & Mfg. Co., Erie and Mission Streets, San Francisco, is an illustrated descriptive price list of stock panels. It contains thirty-six loose-leaf pages, so bound that additional sheets can be readily added. Each page is devoted to one type of panel-board, and contains not only an illustration and description of the board, but also prices.

The General Electric Company, Schenectady, N. Y., in Circular No. 3702, just issued, describes its new Type CR feeder regulator and the benefits to be derived from the use of such apparatus in connection with alternating current lighting systems. This regulator is designed for operation on single-phase 220 volt, 60 cycle circuits, and may be used with either hand or sprocket control.

OBITUARY.

Fred Eric Perrine, Consulting Engineer of New York City, died October 20th at his home at Freehold, N. J., at the age of forty-five. Prior to taking up his work as a consulting engineer in New York, Mr. Perrine occupied the chair of Electrical Engineering at Leland Stanford University, and his many friends on the Pacific Coast will learn of his death with sincere regret.

George E. Dow, president and founder of the Geo. E. Dow Pumping Engine Company, of San Francisco, died last week in Berlin, whither he had gone to consult medical advice. The deceased was fifty-eight years of age, having been born in Kensington, N. H., in 1850. His parents were unable to give him a complete education as a boy, but early in life Dow took up the study of hydraulic engineering, and when yet a young man became proficient in the technicalities of pumping machinery. In 1867 he came to San Francisco, where he engaged in the business of manufacturing machinery, and where he has been identified with all of the business organizations for many years. He was looked upon as an authority on hydraulics and was recognized as a leader in that branch of applied science.

PRESERVATION OF WATER POWERS.

It is reported that a prominent Pacific railway system is soon to construct a railway in Oregon up the Des Chutes River from the Columbia River. Here is a case where one of the largest and best power streams in the Northwest will have its power-producing possibilities wiped out by the construction of railway tracks alongside the bed of the stream. If an individual or a power company were to ask Congress for the right to construct a dam across a river to develop only a small portion of its power, it is probable that such application would be held up and argued over for a long time, with much talk about compensation to the public, etc. But a railway corporation can, under its charter and rights of condemnation, wipe out the development of over 1,000,000 horsepower on a river and nothing is said. Prevention of the development of a water power is certainly worse than development without direct compensation to the public.

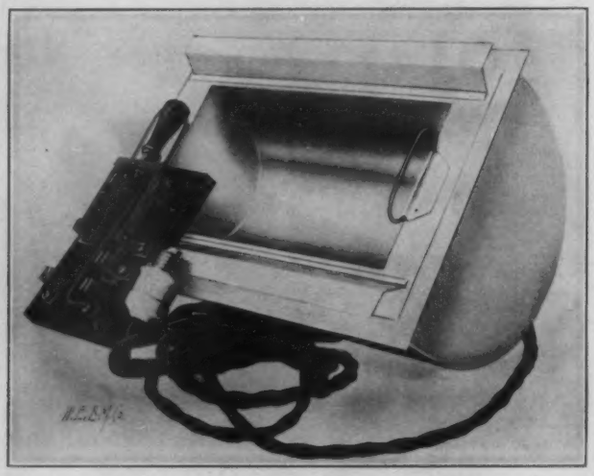
REMOVAL OF JOHN A. ROEBLINGS SONS COMPANY.

The John A. Roeblings Sons Company have removed their San Francisco office from 202 Second Street to their new five-story reinforced concrete warehouse building, 624 to 646 Folsom Street, corner of Hawthorne, at which point Mr. Squire V. Mooney will be glad to welcome all callers.

INDUSTRIAL

ELECTRICALLY HEATED CHOCOLATE WARMERS

Electric heat is particularly well adapted to the demands of the confectioner, supplying a clean, flameless heat which does not increase the amount of moisture in the atmosphere, which can be closely regulated to the requirements of the work, and which is economical. The Hadaway electrically heated dipping pan is designed to meet the demand for a device by which chocolate can be kept in a fluid state at the proper consistency for continuous working or dipping, especially when the work is done in refrigerated rooms. This chocolate warmer has been on the market for the last twelve years and is used by many of the prominent candy manufacturers in this country and abroad.



Hadaway Electrically Heated Chocolate Warmer.

The use of the Hadaway electric chocolate dipping pan gives each dipper a pan of melted chocolate which is maintained at an absolutely uniform temperature. This insures uniform goods and permits uninterrupted work by the dipper. The pan consumes about the same amount of current as a 16-candlepower lamp. The Hadaway chocolate warmers are simple, reliable, and very durable. The heater is placed in operation as simply as an electric incandescent lamp, by closing a switch. There is no water bath or piping to rust and leak. There is no gas flame to vitiate the air. The evaporation from the water bath is cut off and the moisture in the air is reduced to a minimum. A further advantage of the Hadaway electrically heated chocolate warmer for refrigerated rooms arises from the fact that the dry, flameless heat results in a great reduction in the expense for cooling, a feature by no means unimportant.

Hadaway electrically heated chocolate warmers are usually made with a high and a low heat, the change from one to the other being made by a small switch. The low heat is sufficient to maintain the chocolate at the proper working consistency, while the high heat is designed to bring the chocolate to the working temperature in a short time.

The Hadaway electrically heated chocolate warmer is made in two standard sizes. The large size is 14¼ inches long, 7⅝ inches wide, and 6 inches deep. The small size is 12 inches long, 6¼ inches wide, and 5 inches deep. These dimensions refer to the pan in which the chocolate is placed. The heating element is upon the outside of a receptacle in which the chocolate pan is placed and is hermetically sealed in by an outer jacket. The heater and wires are shielded so that accidental contact with them cannot be made and the operators are absolutely protected from all dangers of an electric shock. They are sold by the Westinghouse Electric & Manufacturing Co., of Pittsburg, Pa.

SUCCESS OF NEW HAVEN ELECTRIFICATION.

William S. Murray, electrical engineer of the New York, New Haven & Hartford Railroad Co., which has been operating the Westinghouse single-phase electric railway system on a part of its lines during the last two years, in discussing their experiences with electrification, says:

"The most commercially valuable answer as to the success of electrification on the New Haven, is written in the actual operating schedule in the electrification zone. The train minute delays suffered to-day by electrical operation are but a small percentage of those incurred during the period of steam operation.

"As the zone limits in our case were not a terminal proposition, the application of the direct current showed itself to be impracticable. On account of errors, always common of initiative work, the first few months' operation has been a period of interruption which has naturally been annoying both to the road and the public. To-day the delays have disappeared by the removal of their cause.

"The wisdom of the purchase of a locomotive consisting of two individual half units, the whole or half unit being operative by a single crew, has proved itself in the ability of the road to handle seventy-five per cent of traffic with half unit locomotives, using the whole unit on the remaining twenty-five per cent of trains, whose weight demands the full drawbar. Should future requirements see the advantage of extension of electrification east of Stamford, the system is designedly applicable.

"As to the saving in cost of operation as compared with steam, I would state that operation to-day has not been a sufficient length of time to make this comparison. It may be interesting to note, however, that by exhaustive investigation I have found that one pound of coal burned under the boilers of our central station produces twice the drawbar obtained by one pound of coal burned in the fire-boxes of the steam locomotive; or, in other words, the fuel bill for electric traction is one-half of that required for steam traction. Other economies will arrive in the low cost of maintenance and repairs of the electric locomotive as against steam locomotives.

"The density of traffic is, of course, the paramount feature as to the savings to be effected by electrification. It is not to be forgotten that, in electrifying, interest, depreciation, insurance and taxes follow closely on the heels of the capital investment in equipment and material necessary to electric operation. The heavier the traffic, the greater will be the economies derived from the two above-mentioned sources.

"It is quite conceivable that the heavy ton-mileage in freight and passenger service on the Atlantic Coast line roads will effect savings sufficient to cover the above-mentioned fixed charges on the investment necessary to their electrification.

"The greatest value to be experienced by electrification will be in the tremendously increased traffic capacity of the present track mileages, due to the faciilty electricity offers in making rapid main-line and yard train movement, or, stated in another way, it is thus immediately seen that electrification will permit a tremendous increase of traffic without an increase of track mileage, and thus roads which are up against the requirement of handling their congested traffic by laying new tracks, which, of course, is a most expensive procedure, on account of right-of-way difficulties, will be led into providing an equal capacity by electrification of the old trackage."

NEWS NOTES

TRANSMISSION.

ROSEVILLE, CAL.—An electric plant is to be established at the Pornu quarry near this place.

SONORA, CAL.—S. H. Robinson has filed claims for four water rights aggregating 2500 inches on streams in this vicinity.

ANGELS CAMP, CAL.—F. A. Mitchler has located a water right of 1000 inches in San Domingo Creek near Murphy's.

GRASS VALLEY, CAL.—The Bay Counties Power Company is preparing to put in a syphon pipe on Myer's Ravine, and will replace the flume on Rock Creek with a large pipe.

RED BLUFF, CAL.—E. D. V. Johnson, of the Northern California Power Company, announces that his company will within a few days begin work on a new power plant on the Hazen place.

PLACERVILLE, CAL.—A. R. Sprague has filed notices of two water power claims from the waters of Cold Creek, aggregating 3000 inches. He will develop power for the town of Al Tahoe and for other purposes.

HEALDSBURG, CAL.—The City Trustees have a surveyor at work on plans for the securing of an additional water supply for the municipal power plant. It is intended to nearly or quite double the available water power.

SONORA, CAL.—John C. Benson, a mining man of Angels Camp, has arranged with the Tuolumne Water Power Company to extend the company's transmission line to his property three miles from Angels Camp.

SONORA, CAL.—Herbert Shaw has located a water right of 100,000 miner's inches on the headwaters of Cherry Creek, in Huckleberry Valley. The water is to be conveyed by flume and a pipe line to a power site to be located later.

WINNEMUCCA, NEV.—The County Commissioners of this county have granted to J. E. Webb and A. G. Mollin, of the Golconda Telephone & Power Company, of Golconda, a franchise for a transmission line along the roads of the county.

OGDEN, UTAH.—The Utah Light & Railway Company has awarded to the J. P. O'Neil Construction Company of this city an $80,000 contract in connection with the building of the new power plant to be erected in Weber Canyon. The contract includes a concrete pipe line seven feet in diameter and a half mile long, a thousand foot retaining wall and a dam across the river at the sight of the proposed plant.

SONORA, CAL.—Marsden Manson, City Engineer for San Francisco, has recorded three water power rights here, all located in the vicinity of Hetch Hetchy Valley. One is for 10,000 inches in the Tuolumne River, another for 5000 inches in Eleanor Creek, and a third for 15,000 inches on the Tuolumne River near the mouth of Jawbone Creek. The rights will be used in developing power in connection with the proposed Hetch Hetchy water system for San Francisco.

SAN FRANCISCO.—At a special meeting of the Northern California Power Company in this city a few days ago, 94,780 shares out of a total of 100,000 were present and voting. It was unanimously voted to transfer all of the property of the company to the Northern California Power Company, Consolidated, which was recently organized with a capital stock of $10,000,000 in 100,000 shares of a par value of $100 each. The shareholders of the Northern California Power Company will receive one share of stock in the new company for each share of stock held in the old company. The stockholders of the new company will meet on November 11th to authorize a bond issue of $10,000,000, which will retire the present bond issues of all the companies and provide funds for future needs.

FINANCIAL.

MONROVIA, CAL.—J. H. Adams & Co. have bid $10,250 and accrued interest for the remaining $10,000 of the bond issue recently voted.

SALT LAKE, UTAH.—The City Council has passed an ordinance providing for the issuance of bonds to the amount of $450,000. The bonds will be advertised for sale at once.

LOS ANGELES, CAL.—President A. B. Case, of the Los Angeles Home Telephone Company, has announced that the usual quarterly dividend of $1.25 per share will be paid on November 10th.

SAN FRANCISCO.—The Spring Valley Water Company has given formal notice to the United States Circuit Court of this city of its acceptance of the terms of the temporary injunction recently secured. A surety company will furnish the required bond of $100,000.

PETALUMA, CAL.—According to William E. Early, City Attorney for Petaluma, steps are being taken by the Town Trustees of Petaluma to procure a municipal gas plant. To that end he has been instructed to draw up a resolution calling for a special election to bond the town for the proposed plant, to cost $75,000. Another proposition which will be submitted at the same election will be a high pressure salt water pumping plant for fire protection, to cost about $25,000, and a $10,000 municipal rock crushing plant for street improvement work.

NEW YORK.—Paul Morton and Robert M. Gallaway were elected directors of the Western Union Telegraph Company to succeed the late Morris K. Jessup and John D. Laing. The other directors were re-elected. The annual report of the company for the year ending June 30th shows revenues of $28,528,212, a decrease from the previous year of $4,274,194. The total expenses were $25,179,215, a decrease of $1,352,981, leaving a deficit of $43,825, after the payment of interest and dividends. In the previous year there was a surplus of $36,053. President Clowrey said in his report that the number of messages decreased 12,433,264 during the depression and strike last year, but that there are now many indications of improvement in business.

TELEPHONE AND TELEGRAPH.

CAMP ATASCADERO, CAL.—On October 16th the signal corps at this place effected communication with the United States Navy Yard at Bremerton.

ALAMEDA, CAL.—The Fire and Police Commissioners have decided to ask for an appropriation of $6000 for the purpose of installing a police and fire telephone and light system.

SAN FRANCISCO.—The Central Fire Alarm Station of this city has been shifted from 2034 Steiner Street to 55 Fulton Street, in the same building with the City Electrical Department.

ANACORTES, WASH.—The Independent Telephone Company is now at work on the long distance telephone line leading out of this city, and which they promise will run to Seattle direct.

CLALLAM BAY, WASH.—The company recently organized here by A. Fairservice, K. O. Erickson and G. W. O'Brien, to build a telephone line from Clallam Bay to Mora is so far meeting with success. The capital stock of $2000 is about all taken.

SAN FRANCISCO.—The Supreme Court of the State has decided in favor of the Sunset Telephone & Telegraph Company in the case of M. W. Bradley for damages against the company. The company had appealed from an adverse decision in the Superior Court of Sacramento County

TRANSPORTATION.

HUNTINGTON BEACH, CAL.—Surveyors have begun work on the survey of the Santa Ana-Huntington Beach electric railway.

WILMINGTON, CAL.—The City Council has granted W. T. Wheatly a forty-year franchise for an electric or steam railroad through this place.

EL PASO, TEX.—The El Paso Electric Railway Company is preparing to replace its present line on South El Paso Street with eighty-pound T rails.

LOS ANGELES, CAL.—N. J. Nolan has been awarded a franchise for a double track electric railway on West Washington Street, from Lasaile Avenue to the western city limits.

SANTA BARBARA, CAL.—The City Council has granted a franchise to the Santa Barbara Consolidated Railway Company for an extension and change of route for the Oak Park car line.

SAN FRANCISCO.—The Geary Street & Point Lobos Improvement Association has asked the Board of Supervisors to advertise for sale a franchise for a street railway system on Geary Street.

UNION, ORE.—Work was commenced recently on the construction of an electric line from Union to Baker County, a distance of about thirty-five miles, to connect the Grand Ronde electric power line with the Rock Creek power plant.

BELLINGHAM, WASH.—This week Stone & Webster will begin the location of the line for the Hall's Lake-Everett section of the electric railroad they are to build between Seattle and Bellingham. S. L. Shuffleton is constructing engineer.

VENICE, CAL.—Mr Abbot, of this place, announces that he is going to build an electric railroad through the Rialto district, touching Tokio and going east as far as Compton Road, thence north through the Seagirt tract and back to Venice.

ASTORIA, ORE.—The City Council transacted considerable business at its regular meeting recently, one of the principal matters being the granting of a thirty-year franchise to the Oregon Coast Railway Company for an electric car line over various streets in the city.

SAN DIEGO, CAL.—Col. D. C. Collier, of the Point Loma Electric Railway, has telegraphed from New York that he has succeeded in placing the company's bonds, amounting to $130,000, with New York capitalists. The bond issue is secured by a deed of trust made in favor of the Bank of Commerce Trust Company of this place.

SAN FRANCISCO.—Last week the Board of Supervisors of San Francisco finally passed the ordinance regulating the street railway company and prescribing rules for the protection of the public from danger and inconvenience. The Mayor has notified the officials of the company that he will sign the ordinance. It is expected that the company will contest the constitutionality of the new ordinance.

WATERWORKS.

BRAWLEY, CAL.—D. A. Stormer has subdivided an eight-acre tract and will pipe water to each individual lot.

SEBASTOPOL, CAL.—Sealed bids are being asked for for the proposed extension of the municipal waterworks system.

HEALDSBURG, CAL.—A special committee has been appointed by the Board of Trustees to draft specifications for 2880 feet of 11-inch pipe to replace the pipe now in use at the municipal power plant.

REDONDO, CAL.—Sealed bids are asked for by the Board of Trustees for the furnishing and installing of a centrifugal turbine pump and motor for raising 518 gallons of water against a 200-foot head.

INDEPENDENCE, CAL.—The board of directors of the Independence Waterworks Company has decided to expend between four and five thousand dollars in the improvement of the system here. A new reservoir will be built and other improvements will soon be under way.

LOS ANGELES, CAL.—The Board of Public Works continues to advertise for a large amount of material for the construction of the Owens River aqueduct. Among the later items for which bids are asked are: Air receivers, electric hoists, gate caps, gate valves, water tanks, drills, black iron pipe, O. D. castings, a triplex pump, 12-inch riveted air pipe, cast iron clamps, metal covers, etc. The Board has opened bids for 300 tons of black iron pipe and casing, and for 50,000 cement sacks, but has made no awards on these items. The Board has adopted specifications for another section of the aqueduct, to be known as section 7. It is almost wholly open work, but contains several small tunnels and a few syphons. Bids for this work will be opened November 30th.

ILLUMINATION.

HOLLISTER, CAL.—The City Trustees are asking for bids for the installation of gas and electric fixtures in the new city hall.

LOS ANGELES, CAL.—Two different propositions are now being considered for the electric lighting of the Eagle Rock section.

IMPERIAL, CAL.—W. F. Holt announces that he is planning to build gas plants at several of the towns in the Imperial Valley this winter.

SIERRA MADRE, CAL.—An effort is being made here to bond the town for the purpose of erecting a gas plant. A meeting will be held this week to consider the matter.

VENTURA, CAL.—The Ventura County Power Company has completed the installation of gas mains over the greater portion of the city and is preparing to extend the work still further.

SAUSALITO, CAL.—The Marin Gas Company is making surveys for the foundation of a gas plant, which will be situated near Pine station. The cost of the plant and laying of the gas mains will be $100,000. The consumers will be charged $1.50 per 1,000 cubic feet.

OIL.

IMPERIAL, CAL.—The Standard Oil Company has secured a half acre of land one half mile north of town and is arranging for the construction of large oil tanks for distribution purposes in this territory.

FULLERTON, CAL.—The Puenta Oil Company will soon begin drilling new oil wells on its old lease north of Fullerton. No new wells have been drilled there for the past five years, though the old wells have been kept pumping.

CARSON, NEV.—Something of an oil excitement has developed here. It is alleged that Will U. Mackey, Henry Elges, Otto Schultz and H. F. Bartine of this city have found such good indications that they have refused an offer to sell their oil land for $10,000.

SAN FRANCISCO.—The Standard Oil Company has completed plans for the immediate expenditure of not less than one million dollars in important additions to its plant at Point Richmond. Work is to begin at once with a partial reclamation of a large tract of marsh land, which the company owns. It is stated that not less than ten units of refinery machinery and accessories will be installed. These will represent the development of a new process of refining oil, not hitherto used in any of the plants of the Standard Oil Company.